



Micro-Raman Pigment Analysis of three Icons from Republic of Macedonia

Irena Nastova¹, Orhideja Grupče¹, Biljana Minčeva-Šukarova¹ and Nevenka Veličkovska²

¹Institute of Chemistry, Ss Cyril & Methodius University, PO Box 162, Skopje, Republic of Macedonia

²National Conservation Centre, Laboratory for conservation of icons, Evlija Čelebić b.b., 1001 Skopje, Republic of Macedonia

INTRODUCTION

Three icons: "Hvalite Gospoda" from Kučeviste monastery, village of Kučeviste (beginning of 17th century), "Bogorodica so Isus Hristos" from Kaprinski monastery, village of Orah (16th century) and "Sv. Vasilie and Sv. Nikola" from Gallery of icons in Ohrid (13th century), were analyzed. Micro-Raman spectroscopy was applied in characterization of the pigments and grounds. For identifications of the gold and green colored pigment SEM-EDX analysis was performed.

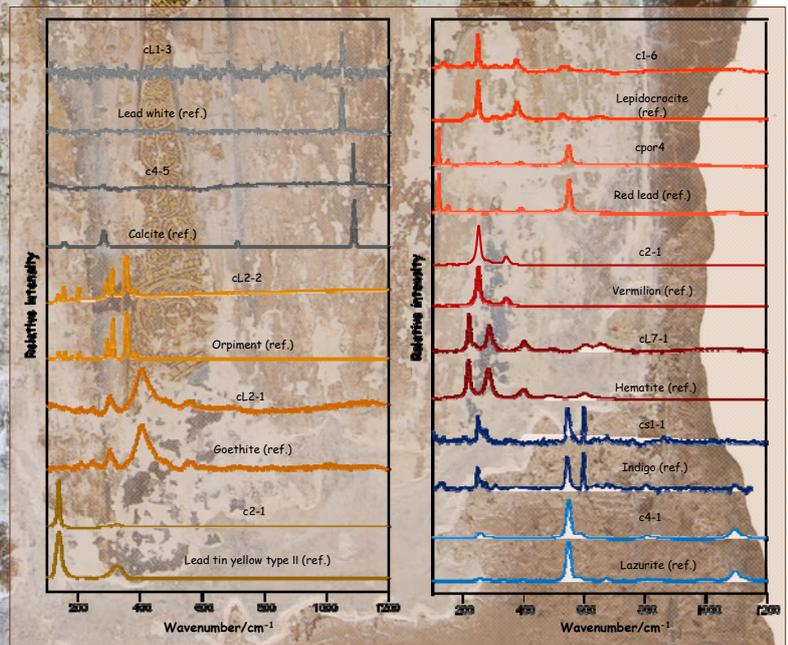
EXPERIMENTAL

Raman spectroscopy analyses were performed on small paint chips provided by restorations/conservators using micro-Raman spectrometer LabRam 300 (Horiba Jobin-Yvon) equipped with a He-Ne laser (632.8 nm) operating with 6 mW at the sample. The spectral resolution was 3-4 cm⁻¹. The laser diameter at the sample was between 1 and 2 μm.

SEM-EDX: Gold and green colored pigments were examined in field emission scanning electron microscopy (FE-SEM-Zeiss Supra 50VP) attached with Energy Dispersive X-ray Spectrometer (EDX-Oxford INCA). The analysis was carried out on the surfaces without coating.

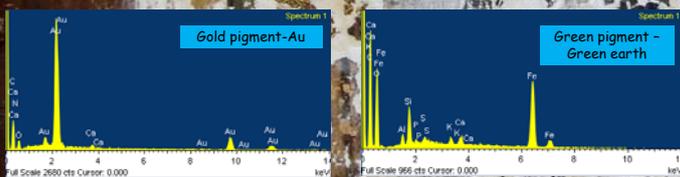
RESULTS

Raman spectra of identified pigments



The analyzed icons: (a) Sv. Vasilie and Sv. Nikola, (b) Bogorodica so Isus Hristos and (c) Hvalite Gospoda

SEM-EDX results from Sv. Vasilie and Sv. Nikola



Pigments identified in analyzed icons

Color	Icons		
	Sv. Vasilie and Sv. Nikola	Hvalite Gospoda	Bogorodica so Isus Hristos
White	Lead white, Calcite	Lead white	Calcite
Beige	Calcite+Goethite+ Lead tin yellow type II +Lepidocrocite+ Hematite+Lazurite+ Carbon black	Vermilion+Calcite +Magnetite	Calcite+Goethite+ Orpiment +Hematite+ Carbon black
Orange	Goethite, Lepidocrocite, Lead tin yellow type II	?	Red lead
Red	Vermilion	Vermilion, Hematite	Hematite
Blue	Lazurite	Lazurite, Indigo	Indigo
Green	Green earth	Indigo+Orpiment, Indigo+Hematite	n/a
Brown	Goethite+Vermilion+ Lazurite	Hematite+Vermilion+ Calcite+Carbon black	n/a
Black	Carbon black	n/a	n/a
Gold	Gold	Gold	Gold

CONCLUSION

- * The color-palette (white, beige, gold, red, green and blue) in three icons was similar. Although icons are painted in different periods, pigments are mostly gold mineral-based (see Table).
- * All icons are painted on ground surface, which mainly consists of calcite, although in Sv. Vasilie and Sv. Nikola icon gypsum was confirmed in the ground as well.
- * Brown and beige colors were obtained using different ratios of several pigments: white, yellow, red and black.
- * The most interesting result was the identification of yellow pigment-lead tin yellow type II in Sv. Vasilie and Sv. Nikola. This pigment is widely used in the medieval icons in Western Europe starting from the 14th century, but it was not identified prior to 1800-40. The identification of this pigment in 13th century icon could be interpreted in several ways: (1) The name of the icon is not correct, (2) The use of the pigments in Byzantine painting started earlier than in Western Europe or (3) The icon has been repaired/recreated in the later